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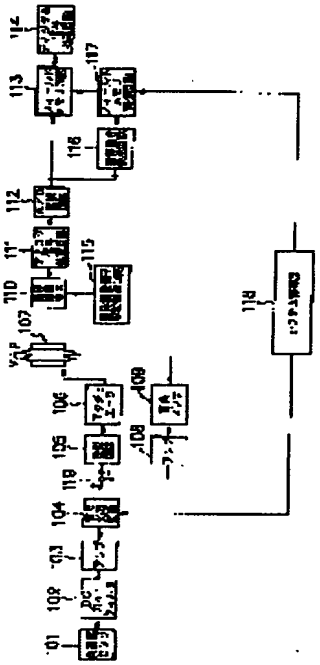
(54) DEVICE AND METHOD FOR CORRECTING OSCILLATION AND COMPUTER READABLE STORAGE MEDIUM

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an oscillation corrector which can remove the oscillation of a low frequency with high accuracy.
SOLUTION: An angular velocity sensor 101 detects the shake of a camera having a solid-state imaging device 110 and by controlling a VAP unit 107 corresponding to the detected shake, the oscillation is optically corrected. On the other hand, an image signal picked-up by the solid-state imaging device 110 is stored in a field memory circuit 113, and the motion of an image is detected by an image motion detecting circuit 116. A field memory control circuit 117 controls the read of the field memory circuit 117 corresponding to the detected motion and a zoom magnification designated from a system control part 118 so as to perform the electronic oscillation correction and electronic zooming.



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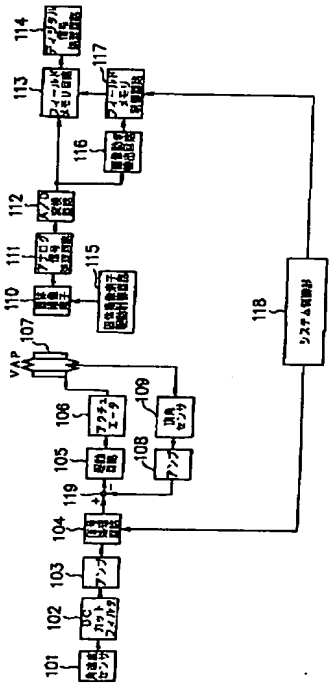
(54)【発明の名称】　振れ補正装置、振れ補正方法及びコンピュータ読み取り可能な記憶媒体

(57)【要約】

【課題】　低周波数の振れを高精度に除去することのできる振れ補正装置を得る。

【解決手段】　固体撮像素子１１０を有するカメラの振れを角速度センサ１０１が検出し、検出した振れに応じてＶＡＰユニット１０７を制御することにより、光学的に振れを補正する。一方、固体撮像素子１１０で撮像した画像信号をフィールドメモリ回路１１３に記憶すると共に、画像動き検出回路１１６で画像の動きを検出する。フィールドメモリ制御回路１１７は、検出された動きとシステム制御部１１８から指定されたズーム倍率とに応じてフィールドメモリ回路１１７の読み出しを制御することにより、電子的な振れ補正と電子ズームとを行う。



【特許請求の範囲】
【請求項１】　撮像手段から入力される画像信号を記憶する記憶手段と、
振れを検出する振れ検出手段と、
上記検出された振れに応じて上記撮像手段に対する被写体像の振れを光学的に補正する光学補正手段と、
上記画像信号の動きを検出する動き検出手段と、
指定されたズーム倍率に応じて上記記憶手段からの画像信号の読み出し範囲の大きさを制御すると共に、上記検出された動きに応じて上記読み出し範囲の位置を制御する制御手段とを備えた振れ補正装置。
【請求項２】　上記制御手段は、上記記憶手段の上記読み出し範囲を除く領域内において、上記読み出し範囲の位置を上記動きを減少させる方向に移動することを特徴とする請求項１記載の振れ補正装置。
【請求項３】　撮像手段から入力される画像信号を記憶手段に記憶する手順と、
振れを検出する手順と、
上記検出された振れに応じて上記撮像手段に対する被写体像の振れを光学的に補正する手順と、
上記画像信号の動きを検出する手順と、
指定されたズーム倍率に応じて上記記憶手段からの画像信号の読み出し範囲の大きさを制御すると共に、上記検出された動きに応じて上記読み出し範囲の位置を制御する手順とを備えた振れ補正方法。
【請求項４】　上記制御する手順においては、上記記憶手段の上記読み出し範囲を除く領域内において、上記読み出し範囲の位置を上記動きを減少させる方向に移動することを特徴とする請求項３記載の振れ補正方法。
【請求項５】　撮像手段から入力される画像信号を記憶手段に記憶する処理と、
振れを検出する処理と、
上記検出された振れに応じて上記撮像手段に対する被写体像の振れを光学的に補正する処理と、
上記画像信号の動きを検出する処理と、
指定されたズーム倍率に応じて上記記憶手段からの画像信号の読み出し範囲の大きさを制御すると共に、上記検出された動きに応じて上記読み出し範囲の位置を制御する処理とを実行するためのプログラムを記憶したコンピュータ読み取り可能な記憶媒体。
【請求項６】　上記制御する処理においては、上記記憶手段の上記読み出し範囲を除く領域内において、上記読み出し範囲の位置を上記動きを減少させる方向に移動することを特徴とする請求項５記載のコンピュータ読み取り可能な記憶媒体。
【請求項７】　振れによる画像の動きを光学的に補正する光学補正手段と、
振れによる画像の動きを電子的に補正する電子補正手段と、
画像を電子的に拡大する電子ズーム手段と、
上記電子ズーム手段の非動作時は、上記光学補正手段によって画像の動きを補正し、上記電子ズーム手段の動作時は、上記光学補正手段と上記電子補正手段の両方を動作させて画像の動きを補正する制御手段とを備えたことを特徴とする振れ補正装置。
【請求項８】　上記制御手段は、上記電子補正手段の補正可能範囲を、上記電子ズーム手段の倍率によって変化させるようにしたことを特徴とする請求項７記載の振れ補正装置。
【請求項９】　振れを物理的に検出する振れ検出手段と、
振れによる画像の動きを画像信号の時間的変化から検出する動き検出手段と、
振れによる画像の動きを光学的に補正する光学補正手段と、
振れによる画像の動きを電子的に補正する電子補正手段と、
上記振れ検出手段の出力に基づいて上記光学補正手段を動作させ、上記動き検出手段の出力に基づいて上記電子補正手段を動作させる制御手段とを備えたことを特徴とする振れ補正装置。
【請求項１０】　画像信号を電子的に拡大する電子ズーム手段を備え、上記制御手段は、画像信号を記憶したメモリからの画像読み出し範囲を変化させて画像の拡大を行い、かつ画像読み出し範囲以外のメモリ内の領域において、上記画像読み出し範囲を移動させることによって電子ズームを行うことを特徴とする請求項９記載の振れ補正装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、ビデオカメラ等に用いて好適な手振れ、振動等の振れ補正をする振れ補正装置、振れ補正方法及びコンピュータ読み取り可能な記憶媒体に関するものである。
【０００２】
【従来の技術】小型のビデオカメラ等では、手振れや振動により被写体像がぶれてしまい、みづらい映像となってしまうことがよくある。最近では高倍率のレンズが採用されており、特にテレ側の時はぶれが大きく目立つ。この手振れ等の振れ補正をするための光学式や電子式の振れ補正装置が従来より数多く提案され、製品化されている。
【０００３】光学式による振れ補正装置として、振れ検出手段に角速度センサを用いると共に、画像補正手段に可変頂角プリズム（以下ＶＡＰ：Variable Angle Prisum と呼ぶ）を用いた例がある。この例では、上記角速度センサの信号をフィルタリングする際、まず直流遮断フィルタにより直流成分を遮断し、手ぶれ補正をするのに必要なだけ増幅した後、必要な信号処理をすることにより上記ＶＡＰの頂角の目標値を得、この目標値に応じて

ＶＡＰの頂角を可変させることにより、振れ補正を行うようにしている。

【０００４】また電子式振れ補正装置は、撮像した画像の動きを検出し、この動きに応じて画像メモリの読み出しを制御するものであり、一般に光学式に比べて低周波特性に優れている。

【０００５】

【発明が解決しようとする課題】上記従来例の光学式振れ補正装置では、角速度センサの特性上、低域周波数の感度が低いという欠点があった。現在の光学系技術の進歩はめざましく、ズームレンズの高倍率化が進んでおり、さらに光学テレ端を介して入力された画像を切り出して電子的に拡大する電子ズーム領域では、角速度センサの低域周波数の感度が低いことにより、低域周波数帯の振れ補正の精度が問題となっていた。

【０００６】本発明は上記の問題を解決するためになされたもので、低域周波数帯の振れを高精度に除去できる振れ補正装置を得ることを目的とする。

【０００７】

【課題を解決するための手段】本発明による振れ補正装置においては、撮像手段から入力される画像信号を記憶する記憶手段と、振れを検出する振れ検出手段と、上記検出された振れに応じて上記撮像手段に対する被写体像の振れを光学的に補正する光学補正手段と、上記画像信号の動きを検出する動き検出手段と、指定されたズーム倍率に応じて上記記憶手段からの画像信号の読み出し範囲の大きさを制御すると共に、上記検出された動きに応じて上記読み出し範囲の位置を制御する制御手段とを設けている。

【０００８】本発明による振れ補正方法においては、撮像手段から入力される画像信号を記憶手段に記憶する手順と、振れを検出する手順と、上記検出された振れに応じて上記撮像手段に対する被写体像の振れを光学的に補正する手順と、上記画像信号の動きを検出する手順と、指定されたズーム倍率に応じて上記記憶手段からの画像信号の読み出し範囲の大きさを制御すると共に、上記検出された動きに応じて上記読み出し範囲の位置を制御する手順とを設けている。

【０００９】本発明によるコンピュータ読み取り可能な記憶媒体においては、撮像手段から入力される画像信号を記憶手段に記憶する処理と、振れを検出する処理と、上記検出された振れに応じて上記撮像手段に対する被写体像の振れを光学的に補正する処理と、上記画像信号の動きを検出する処理と、指定されたズーム倍率に応じて上記記憶手段からの画像信号の読み出し範囲の大きさを制御すると共に、上記検出された動きに応じて上記読み出し範囲の位置を制御する処理とを実行するためのプログラムを記憶している。

【００１０】本発明による他の振れ補正装置においては、振れによる画像の動きを光学的に補正する光学補正手段と、振れによる画像の動きを電子的に補正する電子補正手段と、画像を電子的に拡大する電子ズーム手段と、上記電子ズーム手段の非動作時は、上記光学補正手段によって画像の動きを補正し、上記電子ズーム手段の動作時は、上記光学補正手段と上記電子補正手段の両方を動作させて画像の動きを補正する制御手段とを設けている。

【００１１】本発明による更に他の振れ補正装置においては、振れを物理的に検出する振れ検出手段と、振れによる画像の動きを画像信号の時間的変化から検出する動き検出手段と、振れによる画像の動きを光学的に補正する光学補正手段と、振れによる画像の動きを電子的に補正する電子補正手段と、上記振れ検出手段の出力に基づいて上記光学補正手段を動作させ、上記動き検出手段の出力に基づいて上記電子補正手段を動作させる制御手段とを設けている。

【００１２】

【発明の実施の形態】以下、本発明の実施の形態を図面と共に説明する。まず、本実施の形態で用いられる光学補正手段としてのＶＡＰについて図２と共に説明する。図２に示すようにＶＡＰは、対向した２枚のガラス板２１、２２と、この２枚のガラス板２１、２２をつなぐ蛇腹２３、２４と、２枚のガラス板２１、２２と蛇腹２３、２４とで密閉される空間を満たす高屈折率液体２５とにより構成される。ガラス板２１、２２には、互いに直交する回転軸２６、２７がそれぞれ設けられている。

【００１３】図２において、一方のガラス板２１を回転軸２６を中心にσだけ回転させたときの入射光束２８は楔形プリズムと同じ原理によりφだけ偏向する。同じようにもう一方のガラス板２２は、回転軸２７を中心に回転し入射光束２８を偏向させることができる。このように、２枚のガラス板２１、２２を同時に制御することにより、被写体像のぶれを除去することができる。

【００１４】次に本発明の実施の形態による上記ＶＡＰを用いた手振れ補正装置について図１と共に説明する。なお、本手振れ補正装置においては、図１の構成の内１０１から１０６、１０８、１０９、１１８の各ブロックがピッチ（縦）方向、ヨー（横）方向に独立して２系統を持つものとして、ここでは１系統のみ図示している。

【００１５】図１において、撮像部の振れを検出する振れ検出手段としての角速度センサ１０１の出力を、ＤＣカットフィルタ１０２によって直流成分をカットして振れ成分のみを抽出した後、アンプ１０３で必要なだけ増幅する。この増幅された信号からＶＡＰ頂角の目標値を生成するのに必要な信号処理を信号処理回路１０４で行う。すなわち、振れ成分を相殺するのに必要なＶＡＰの駆動量が演算される。

【００１６】また、ＶＡＰユニット１０７には頂角を検出する頂角センサ１０９があり、実際のＶＡＰの駆動量、すなわち傾き量を検出できる。そして、その出力を

アンプ１０８で必要なだけ増幅する。次に、減算器１１９で信号処理回路１０４とアンプ１０８の各出力の差を取り、これを制御量として駆動回路１０５に出力する。これにより駆動回路１０５が、ＶＡＰユニット１０７内のＶＡＰの頂角を可変させるアクチュエータ１０６を駆動する。この一連の動作により、光学的に振れを補正する。

【００１７】また、システム制御部１１８は、手ぶれ補正のＯＮ／ＯＦＦ、パンニング時（撮影者が意図的にパン又はチルトをしていると判断したとき）の制御、又は三脚等の安定した場所に設置された時の制御のために信号処理回路１０４の信号処理を最適化すべく、これを制御する。なお、信号処理回路１０４はソフトウェアでも良い。

【００１８】一方、固体撮像素子１１０は、光学系を介した被写体像を電気信号（以下、画像信号と呼ぶ）に変換する。この画像信号をアナログ信号処理回路１１１により信号処理を行い、さらにＡ／Ｄ変換回路１１２によりディジタル信号に変換する。このディジタル信号に変換された画像信号をフィールドメモリ回路１１３に記憶する。また、ディジタル信号に変換された上記画像信号は動き検出手段としての画像動き検出回路１１６にも送られ、ここでフィールド間又はフレーム間の画像の動きを検出する。

【００１９】フィールドメモリ制御回路１１７は、システム制御部１１８から電子ズーム（画像の電子的拡大）処理の命令が来たとき、その命令の倍率に応じて画像を拡大するようにフィールドメモリ回路１１３の読み出しを制御する。この時、フィールドメモリ回路１１３に記憶された画像から、フィールドメモリ制御回路１１７により読み出される画像を引いた残りの領域内で、読み出す位置を検出された画像の動きを打ち消すように移動させて電子的な振れ補正を行うことができる。

【００２０】この移動可能な範囲内で、システム制御部１１８から振れ補正ＯＮの命令が来ているとき、画像動き検出回路１１６からの信号に応じてフィールドメモリ制御回路１１７により読み出すアドレスを移動することにより、電子式の振れ補正を行う。フィールドメモリ回路１１３から読み出された画像はディジタル信号処理回路１１４により放送方式に合わせた標準の画素数に補間されて出力される。

【００２１】図３は、本発明の手振れ補正装置の動作を示すフローチャートであり、システム制御部１１８によって実行される。制御をスタートすると、ステップＳ１で、角速度センサ１０１で物理的に検出された振れに基づいて、振れによる画像の動きを相殺する方向及び量を演算し、ステップＳ２でＶＡＰ１０７を駆動する。これによって光学的振れ補正、すなわち光学防振動作が行われる。防振動作が行われている間は、この光学防振動作は常に行われている。

【００２２】続いてステップＳ３で、フィールドメモリ回路１１３からの画像の読み出し範囲を小さくすることによって、電子的に画角を小さくする電子ズーム動作がＯＮであるか否かを判定し、電子ズームがＯＦＦであったときには、そのままフローを抜けて、光学防振のみの防振動作を続行する。ステップＳ３で電子ズームがＯＮであった場合には、ステップＳ４で、画像動き検出回路１１６において、連続して生成されるフィールド画面間の画像の変化から画像の動き情報を検出し、ステップＳ５で電子ズームの倍率を設定し、ステップＳ６の処理に移行する。

【００２３】ステップＳ６では、まずステップＳ５の処理で設定された電子ズーム倍率に応じて、フィールドメモリ回路１１３より画像を読み出す範囲を設定し、かつステップＳ４の処理で検出した画像の動き情報に応じて、画像を読み出す範囲を、上記フィールドメモリ回路の画像格納領域内において移動制御、すなわち画像の動きを相殺する方向にシフトすることにより、画像の動き（振れ）補正が行われる。この時、画像の動き補正可能な補正量は、上記フィールドメモリ回路の画像格納領域に相当する全画面領域と、読み出す範囲との差の領域の範囲内ということになる。ステップＳ７では、ステップＳ６においてフィールドメモリ回路１１３より読み出された部分画像を通常の表示画面の大きさに電子的に拡大する処理が行われる。この際に、画像拡大処理に伴う画像情報の欠落部分は補間処理が行われ、電子的に拡大処理された画像が出力される。以上のステップＳ１～Ｓ７の処理を繰り返し行う。

【００２４】尚、上述の処理によれば、光学防振は常に動作し、基本的には画像の劣化の少ない光学防振を用いる。そして、電子ズームが動作しているときには、電子ズームによって画像のメモリからの切り出し位置が縮小されることによって生じる、画像読み出し部分以外の余白の部分を画像読み出し範囲の移動可能範囲として、電子的な動き補正を実行し、電子防振を併用する。但し、振れ補正可能範囲は電子ズームの倍率によって変化する。これによって、拡大処理による移動制御、すなわち画像の動きを相殺する方向にシフトすることにより、画像の動き（振れ）補正が行われる。

【００２５】すなわち、電子ズーム非動作時には、光学防振のみで振れ補正を行い、電子ズーム動作時には、光学防振と電子防振の両方を用いて振れ補正を行う。電子防振を併用することによって、角速度センサによる低周波域における感度低下を画像からの動き情報で電子防振を行うことによって補償することができる。すなわち、電子ズーム領域では、画像が拡大されているため、低域の振れが画面上で大きく作用し、目立つ傾向にあるが、角速度サンセは低周波域の感度が良くないので、電子ズーム時は特に振れ補正能力の低下が目立っていたが、電子ズーム時に上記の電子防振を併用することで、この問

題を解決することができる。

【００２６】このように、振れ検出手段として角速度センサと、画像検出を備え、補正手段にも光学補正手段と、画像処理による電子防振を備え、これらの組み合わせによって、画質と振れ補正能力の両面において、最適化を図ることができる。

【００２７】尚、図１の各機能ブロックは、ハード的に構成してもよく、また、ＣＰＵやメモリ等から成るマイクロコンピュータシステムに構成してもよい。マイクロコンピュータシステムに構成する場合、上記メモリは本発明による記憶媒体を構成し、この記憶媒体には、上述した動作を行うための処理を実行するためのプログラムが記録される。また、この記録媒体としては、ＲＯＭ、ＲＡＭ等の半導体メモリや、光ディスク、光磁気ディスク、磁気媒体等を用いてよく、これらをＣＤ－ＲＯＭ、フロッピィディスク、磁気テープ、不揮発性のメモリカード等として用いてよい。

【００２８】

【発明の効果】以上説明したように、本発明によれば、電子ズーム中のみ光学式振れ補正と低周波数特性の良い電子式振れ補正とを併用することにより、電子ズーム領域において光学式振れ補正装置で問題となる低域周波数帯の振れを高精度に除去して画質劣化のない振れ補正を実現することができる。

【図面の簡単な説明】

【図１】本発明による振れ補正装置の実施の形態を示すブロック図である。

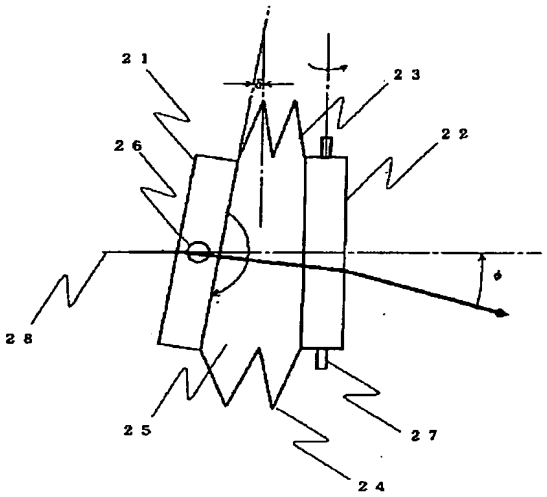
【図２】可変頂角プリズムの構成図である。

【図３】システム制御部の処理を説明するためのフローチャートである。

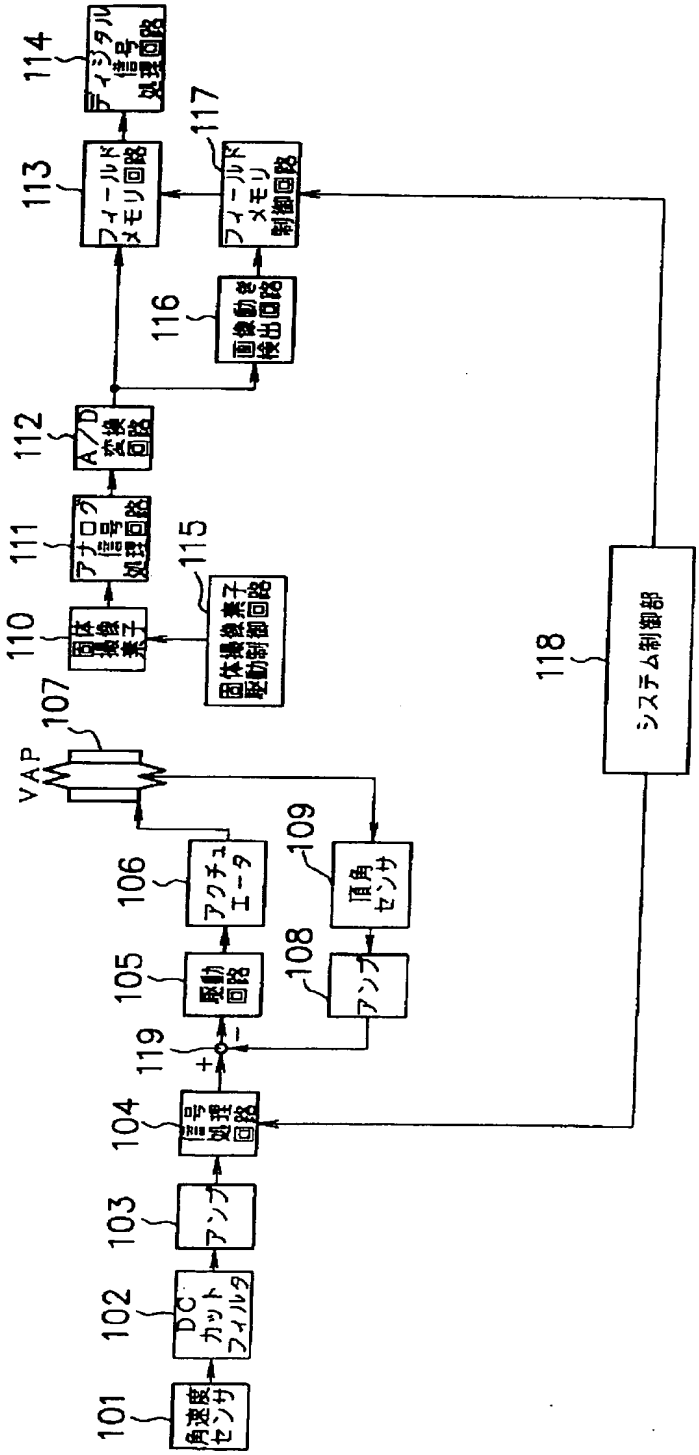
【符号の説明】

１０１　角速度センサ
１０６　アクチュエータ
１０７　ＶＡＰユニット
１０８　頂角センサ
１１０　固体撮像素子
１１３　フィールドメモリ回路
１１６　画像動き検出回路
１１７　フィールドメモリ制御回路
１１８　システム制御部

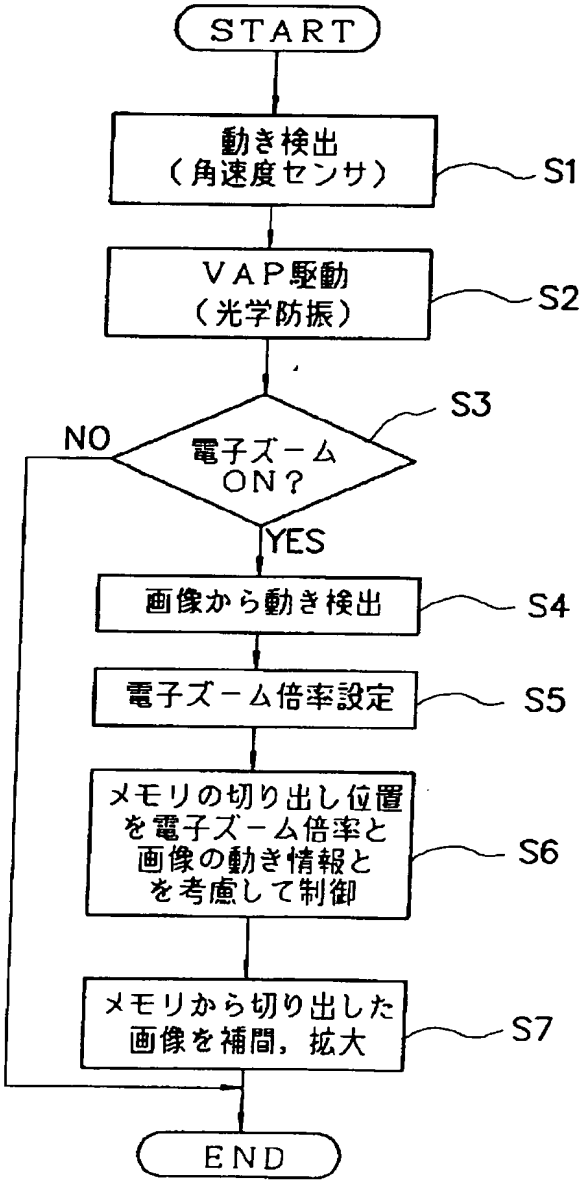
【図２】



【図１】


101
角速度センサ
102
DCカットフィルタ
103
アンプ
104
信号処理回路
105
駆動回路
106
アクチュエータ
107
VAP
108
アンプ
109
傾角センサ
110
固体撮像素子
111
アナログ信号処理回路
112
A/D変換回路
113
フィールドメモリ回路
114
ディジタル信号処理回路
115
固体撮像素子駆動制御回路
116
画像動き検出回路
117
フィールドメモリ制御回路
118
システム制御部
119
+
−

【図３】


START
動き検出
（角速度センサ）
S1
VAP駆動
（光学防振）
S2
S3
NO
電子ズーム
ON？
YES
画像から動き検出
S4
電子ズーム倍率設定
S5
メモリの切り出し位置
を電子ズーム倍率と
画像の動き情報と
を考慮して制御
S6
メモリから切り出した
画像を補間，拡大
S7
END

PATENT ABSTRACTS OF JAPAN

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G03B 5/00

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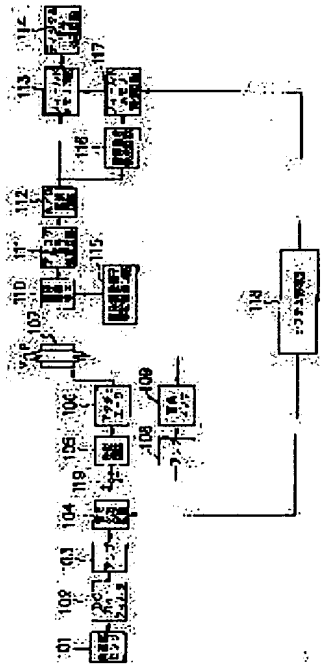
(22)Date of filing : 13.11.1997

(71)Applicant : CANON INC
(72)Inventor : KUDO TOSHIMICHI

(54) DEVICE AND METHOD FOR CORRECTING OSCILLATION AND COMPUTER READABLE STORAGE MEDIUM

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an oscillation corrector which can remove the oscillation of a low frequency with high accuracy.
SOLUTION: An angular velocity sensor 101 detects the shake of a camera having a solid-state imaging device 110 and by controlling a VAP unit 107 corresponding to the detected shake, the oscillation is optically corrected. On the other hand, an image signal picked-up by the solid-state imaging device 110 is stored in a field memory circuit 113, and the motion of an image is detected by an image motion detecting circuit 116. A field memory control circuit 117 controls the read of the field memory circuit 117 corresponding to the detected motion and a zoom magnification designated from a system control part 118 so as to perform the electronic oscillation correction and electronic zooming.



LEGAL STATUS

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[Date of requesting appeal against examiner's	

* NOTICES *

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3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] A storage means to memorize the picture signal inputted from an image pick-up means, and a deflection detection means to detect a deflection, An optical amendment means to amend optically the deflection of the photographic subject image to the above-mentioned image pick-up means according to the deflection by which detection was carried out [above-mentioned], the deflection compensator equipped with the control means which carries out reading appearance and controls [above-mentioned] the location of the range according to the motion by which detection was carried out [above-mentioned] while the picture signal from the above-mentioned storage means carries out reading appearance according to the zoom scale factor specified as a motion detection means to detect a motion of the above-mentioned picture signal and controlling the magnitude of the range.
[Claim 2] The above-mentioned control means is a deflection compensator according to claim 1 characterized by moving the location of the above-mentioned read-out range in the direction which decreases the above-mentioned motion into the field except the above-mentioned read-out range of the above-mentioned storage means.
[Claim 3] The procedure of memorizing the picture signal inputted from an image pick-up means for a storage means, and the procedure of detecting a deflection, The procedure which amends optically the deflection of the photographic subject image to the above-mentioned image pick-up means according to the deflection by which detection was carried out [above-mentioned], the deflection amendment approach equipped with the procedure which carries out reading appearance and controls [above-mentioned] the location of the range according to the motion by which detection was carried out [above-mentioned] while the picture signal from the above-mentioned storage means carried out reading appearance according to the zoom scale factor specified as the procedure of detecting a motion of the above-mentioned picture signal and controlling the magnitude of the range.
[Claim 4] The deflection amendment approach according to claim 3 characterized by moving the location of the above-mentioned read-out range in the direction which decreases the above-mentioned motion in the above-mentioned procedure which carries out control into the field except the above-mentioned read-out range of the above-mentioned storage means.
[Claim 5] The processing which memorizes the picture signal inputted from an image pick-up means for a storage means, and the processing which detects a deflection, The processing which amends optically the deflection of the photographic subject image to the above-mentioned image pick-up means according to the deflection by which detection was carried out [above-mentioned], While controlling the magnitude of the read-out range of the picture signal from the above-mentioned storage means according to the zoom scale factor specified as the processing which detects a motion of the above-mentioned picture signal The storage which memorized the program for performing processing which controls the location of the above-mentioned read-out range according to the motion by which detection was carried out [above-mentioned] and in which computer reading is possible.
[Claim 6] The storage which is characterized by moving the location of the above-mentioned read-out range in the direction which decreases the above-mentioned motion in the above-mentioned processing which carries out control into the field except the above-mentioned read-out range of the above-mentioned storage means and in which computer reading according to claim 5 is possible.
[Claim 7] An optical amendment means to amend a motion of the image by the deflection optically, and an

electronic amendment means to amend a motion of the image by the deflection electronically, At the time of un-operating [of an electronic zoom means to expand an image electronically, and the above-mentioned electronic zoom means] It is the deflection compensator characterized by for the above-mentioned optical amendment means having amended the motion of an image, and having the control means which both the above-mentioned optical amendment means and the above-mentioned electronic amendment means are operated, and amends a motion of an image at the time of actuation of the above-mentioned electronic zoom means.

[Claim 8] The above-mentioned control means is a deflection compensator according to claim 7 characterized by making it change the range of the above-mentioned electronic amendment means which can be amended with the scale factor of the above-mentioned electronic zoom means.

[Claim 9] A deflection detection means to detect a deflection physically, and a motion detection means to detect a motion of the image by the deflection from the temporal response of a picture signal, An optical amendment means to amend a motion of the image by the deflection optically, and an electronic amendment means to amend a motion of the image by the deflection electronically, The deflection compensator characterized by having the control means which operates the above-mentioned optical amendment means based on the output of the above-mentioned deflection detection means, and operates the above-mentioned electronic amendment means based on the output of the above-mentioned motion detection means.

[Claim 10] It is the deflection compensator according to claim 9 characterized by performing an electronic zoom by the above-mentioned control means's changing the image read-out range from the memory which memorized the picture signal, and expanding an image by having an electronic zoom means to expand a picture signal electronically, and moving the above-mentioned image read-out range in the field in memory other than the image read-out range.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the deflection compensator which uses for a video camera etc. and carries out deflection amendment of a suitable hand deflection, an oscillation, etc., the deflection amendment approach, and the storage in which computer reading is possible.
[0002]
[Description of the Prior Art] In a small video camera, a photographic subject image blurs by the hand deflection or oscillation, and it sometimes often becomes the image which is hard to see. Recently, the lens of a high scale factor is adopted, and blurring is greatly conspicuous when it is especially a call side. Many deflection compensators of optical [for carrying out deflection amendment of this hand deflection etc.] or an electronic formula are proposed conventionally, and are produced commercially.
[0003] As a deflection compensator by optical, while using an angular-velocity sensor for a deflection detection means, there is an example which used adjustable vertical-angle prism (it is called VAP:Variable Angle Prisum below) for the image amendment means. In this example, in case the signal of the above-mentioned angular-velocity sensor is filtered, it is made to perform deflection amendment by intercepting a dc component with a direct-current cutoff filter first, acquiring the desired value of the vertical angle of Above VAP, and carrying out adjustable [of the vertical angle of VAP] according to this desired value by carrying out required signal processing, after amplifying as required to carry out blurring amendment.
[0004] Moreover, an electronic formula deflection compensator detects a motion of the picturized image, controls read-out of an image memory according to this motion, and, generally is excellent in the low frequency property compared with optical.
[0005]
[Problem(s) to be Solved by the Invention] In the optical deflection compensator of the above-mentioned conventional example, there was a fault that the sensibility of a low-pass frequency was low on the property of an angular-velocity sensor. In the electronic zoom field which an advance of a current optical-system technique be remarkable, and high scale-factor-ization of a zoom lens be progress, cut down the image further inputted through the optical tele edge, and be expand electronically, the precision of deflection amendment of a low-pass frequency band had became a problem according to the sensibility of the low-pass frequency of an angular-velocity sensor be low.
[0006] It was made in order that this invention might solve the above-mentioned problem, and it aims at obtaining the deflection compensator from which the deflection of a low-pass frequency band is removable to high degree of accuracy.
[0007]
[Means for Solving the Problem] A storage means to memorize the picture signal inputted from an image pick-up means in the deflection compensator by this invention, A deflection detection means to detect a deflection, and an optical amendment means to amend optically the deflection of the photographic subject image to the above-mentioned image pick-up means according to the deflection by which detection was carried out [above-mentioned], while the picture signal from the above-mentioned storage means carries out reading appearance according to the zoom scale factor specified as a motion detection means to detect a motion of the above-mentioned picture signal and controlling the magnitude of the range, according to the motion by which detection was carried out [above-mentioned], the control means which carries out reading appearance and

controls [above-mentioned] the location of the range is established.
[0008] The procedure of memorizing the picture signal inputted from an image pick-up means for a storage means in the deflection amendment approach by this invention, The procedure of detecting a deflection, and the procedure which amends optically the deflection of the photographic subject image to the above-mentioned image pick-up means according to the deflection by which detection was carried out [above-mentioned], while the picture signal from the above-mentioned storage means carries out reading appearance according to the zoom scale factor specified as the procedure of detecting a motion of the above-mentioned picture signal and controlling the magnitude of the range, according to the motion by which detection was carried out [above-mentioned], the procedure which carries out reading appearance and controls [above-mentioned] the location of the range is formed.
[0009] In the storage by this invention in which computer reading is possible The processing which memorizes the picture signal inputted from an image pick-up means for a storage means, and the processing which detects a deflection, The processing which amends optically the deflection of the photographic subject image to the above-mentioned image pick-up means according to the deflection by which detection was carried out [above-mentioned], while the picture signal from the above-mentioned storage means carries out reading appearance according to the zoom scale factor specified as the processing which detects a motion of the above-mentioned picture signal and controlling the magnitude of the range, the program for performing processing which carries out reading appearance and controls [above-mentioned] the location of the range according to the motion by which detection was carried out [above-mentioned] has memorized.
[0010] An optical amendment means to amend a motion of the image by the deflection optically in other deflection compensators by this invention, At the time of un-operating [of an electronic amendment means to amend a motion of the image by the deflection electronically, an electronic zoom means to expand an image electronically, and the above-mentioned electronic zoom means] The above-mentioned optical amendment means amended the motion of an image, and the control means which both the above-mentioned optical amendment means and the above-mentioned electronic amendment means are operated, and amends a motion of an image is established at the time of actuation of the above-mentioned electronic zoom means.
[0011] In the deflection compensator of further others by this invention A deflection detection means to detect a deflection physically, and a motion detection means to detect a motion of the image by the deflection from the temporal response of a picture signal, An optical amendment means to amend a motion of the image by the deflection optically, and an electronic amendment means to amend a motion of the image by the deflection electronically, The control means which operates the above-mentioned optical amendment means based on the output of the above-mentioned deflection detection means, and operates the above-mentioned electronic amendment means based on the output of the above-mentioned motion detection means is established.
[0012]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with a drawing. First, VAP as an optical amendment means used with the gestalt of this operation is explained with drawing 2 . VAP is constituted by the high refractive-index liquid 25 which fills the space sealed with the bellows 23 and 24 which connect the glass plates 21 and 22 of two sheets which countered, and these glass plates 21 and 22 of two sheets, and the glass plates 21 and 22 of two sheets and bellows 23 and 24 as shown in drawing 2 . The revolving shafts 26 and 27 which intersect perpendicularly mutually are formed in glass plates 21 and 22, respectively.
[0013] In drawing 2 , the incoming beams 28 when only sigma rotates one glass plate 21 centering on a revolving shaft 26 deflect only phi by the same principle as wedge prism. Similarly, another glass plate 22 can be rotated centering on a revolving shaft 27, and can deflect incoming beams 28. Thus, blurring of a photographic subject image is removable by controlling the glass plates 21 and 22 of two sheets simultaneously.

[0014] Next, the hand deflection compensator using the above VAP by the gestalt of operation of this invention is explained with drawing 1 . In addition, in a **** deflection compensator, one line is illustrated here as that to which each block of 101 to 106, 108, 109, and 118 has two lines in the pitch (length) direction and the direction of a yaw (width) independently among the configurations of drawing 1 .
[0015] In drawing 1 , after cutting a dc component for the output of the angular-velocity sensor 101 as a deflection detection means to detect the deflection of the image pick-up section, by the DC cut-off filter 102 and

extracting only a deflection component, it amplifies as required of amplifier 103. Signal processing required to generate the desired value of a VAP vertical angle from this amplified signal is performed by the digital disposal circuit 104. That is, the amount of actuation of VAP required to offset a deflection component calculates.

[0016] Moreover, there is a vertical-angle sensor 109 which detects a vertical angle in the VAP unit 107, and it can detect, the amount of actuation of inclinations, i.e., amount, of actual VAP. And the output is amplified as required of amplifier 108. Next, the difference of each output of a digital disposal circuit 104 and amplifier 108 is taken with a subtractor 119, and it outputs to the actuation circuit 105 by making this into a controlled variable. Thereby, the actuation circuit 105 drives the actuator 106 to which it carries out adjustable [of the vertical angle of VAP in the VAP unit 107]. This the actuation of a series of amends a deflection optically.

[0017] Moreover, the system control section 118 controls this that signal processing of a digital disposal circuit 104 should be optimized for the control when being installed in the location stabilized [tripod / ON/OFF of blurring amendment, the control at the time of panning (when a photography person judges that the pan or the tilt is carried out intentionally), or]. In addition, software is sufficient as a digital disposal circuit 104.

[0018] On the other hand, a solid state image pickup device 110 changes the photographic subject image through optical system into an electrical signal (it is hereafter called a picture signal). The analog signal processing circuit 111 performs signal processing, and this picture signal is further changed into a digital signal by the A/D-conversion circuit 112. The picture signal changed into this digital signal is memorized in the field memory circuit 113. Moreover, the above-mentioned picture signal changed into the digital signal moves, is sent also to the image motion detector 116 as a detection means, and detects a motion of between the fields or an inter-frame image here.

[0019] The field memory control circuit 117 controls read-out of the field memory circuit 113 to expand an image according to the scale factor of the instruction, when an instruction of electronic zoom (electronic amplification of image) processing comes from the system control section 118. At this time, it can be made to be able to move so that the motion of an image which had the location read from the image memorized in the field memory circuit 113 in the remaining fields which lengthened the image by which reading appearance is carried out in the field memory control circuit 117 detected may be negated, and electronic deflection amendment can be performed.

[0020] While the instruction of the deflection amendment ON is coming within the limits of [movable] this from the system control section 118, deflection amendment of an electronic formula is performed by moving in the address read by the field memory control circuit 117 according to the signal from the image motion detector 116. The image by which reading appearance was carried out is interpolated and outputted to the number of pixels of the criterion doubled with the broadcasting format by the digital-signal-processing circuit 114 from the field memory circuit 113.

[0021] Drawing 3 is a flow chart which shows actuation of the hand deflection compensator of this invention, and is performed by the system control section 118. If control is started, based on the deflection physically detected by the angular-velocity sensor 101 at step S1, the direction and amount which offset a motion of the image by the deflection will be calculated, and VAP107 will be driven at step S2. Optical deflection amendment, i.e., optical vibration control actuation, is performed by this. While vibration control actuation is performed, this optical vibration control actuation is always performed.

[0022] then, at step S3, it judges whether the electronic zoom actuation which makes a field angle small electronically by [of the image from the field memory circuit 113] carrying out reading appearance and making the range small is ON, and when an electronic zoom is OFF, it escapes from a flow as it is, and vibration control actuation of only optical vibration control is continued. When an electronic zoom is ON at step S3, in step S4, in the image motion detector 116, the motion information on an image is detected from change of the image between the field and the screen generated continuously, the scale factor of an electronic zoom is set up at step S5, and it shifts to processing of step S6.

[0023] At step S6, it responds to the electronic zoom scale factor first set up by processing of step S5. It responds to the motion information on the image which set up the range which reads an image from the field memory circuit 113, and was detected by processing of step S4. Motion (shake) amendment of an image is performed by shifting the range which reads an image in the direction which offsets migration control, i.e., a motion of an image, in the image storing field of the above-mentioned field memory circuit. At this time, the

amount of amendments in which motion amendment of an image is possible will be called within the limits of the full-screen field equivalent to the image storing field of the above-mentioned field memory circuit, and the field of a difference with the range to read. At step S7, processing to which the partial image by which reading appearance was carried out from the field memory circuit 113 in step S6 is electronically expanded to the magnitude of the usual display screen is performed. In this case, as for the lack part of the image information accompanying image amplification processing, the image with which interpolation processing was performed and amplification processing was electronically carried out is outputted. Processing of the above steps S1-S7 is repeated, and is performed.

[0024] In addition, according to above-mentioned processing, optical vibration control always operates and uses optical vibration control with little degradation of an image fundamentally. And while an electronic zoom is operating, electronic motion amendment is performed for the part of margins other than an image read-out part produced by reducing the logging location from the memory of an image by the electronic zoom as movable range of the image read-out range, and electronic vibration control is used together. However, the range which can be deflection amended changes with the scale factors of an electronic zoom. Motion (shake) amendment of an image is performed by shifting in the direction which offsets the migration control by amplification processing, i.e., a motion of an image, by this.

[0025] That is, at the time of electronic zoom un-operating, deflection amendment is performed only by optical vibration control, and deflection amendment is performed using both optical vibration control and electronic vibration control at the time of electronic zoom actuation. By using electronic vibration control together, the sensibility lowering in the low frequency region by the angular-velocity sensor can be compensated by performing electronic vibration control for the motion information from an image. That is, especially at the time of an electronic zoom, although a low-pass deflection is in the inclination which acts greatly on a screen and is conspicuous since the image is expanded, since angular-velocity SANSE does not have the good sensibility of a low frequency region, although lowering of deflection amendment capacity was conspicuous, this problem is solvable [by using together the above-mentioned electronic vibration control at the time of an electronic zoom] in an electronic zoom field.

[0026] Thus, as a deflection detection means, it can have an angular-velocity sensor and image detection, an amendment means can also be equipped with an optical amendment means and the electronic vibration control by the image processing, and optimization can be attained in both sides of image quality and deflection amendment capacity with such combination.

[0027] In addition, each functional block of drawing 1 may be constituted to the microcomputer system which may constitute in hard and consists of CPU, memory, etc. When it constitutes to a microcomputer system, the above-mentioned memory constitutes the storage by this invention, and the program for performing processing for performing actuation mentioned above is recorded on this storage. Moreover, as this record medium, semiconductor memory, such as ROM and RAM, an optical disk, a magneto-optic disk, a magnetic medium, etc. may be used, and these may be used as a memory card of CD-ROM, a floppy disk, a magnetic tape, and a non-volatile etc.

[0028]

[Effect of the Invention] As explained above, when only the inside of an electronic zoom uses together optical deflection amendment and the electronic formula deflection amendment with a sufficient low frequency property, according to this invention, the deflection amendment which removes the deflection of the low-pass frequency band which poses a problem with an optical deflection compensator in an electronic zoom field to high degree of accuracy, and does not have image quality degradation is realizable.

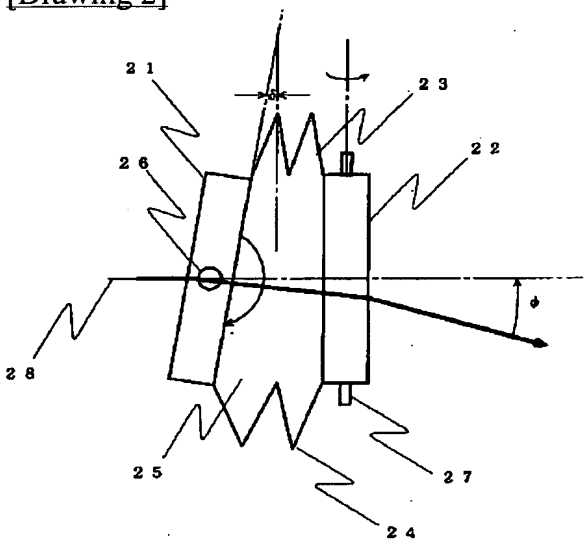
[Translation done.]

* NOTICES *

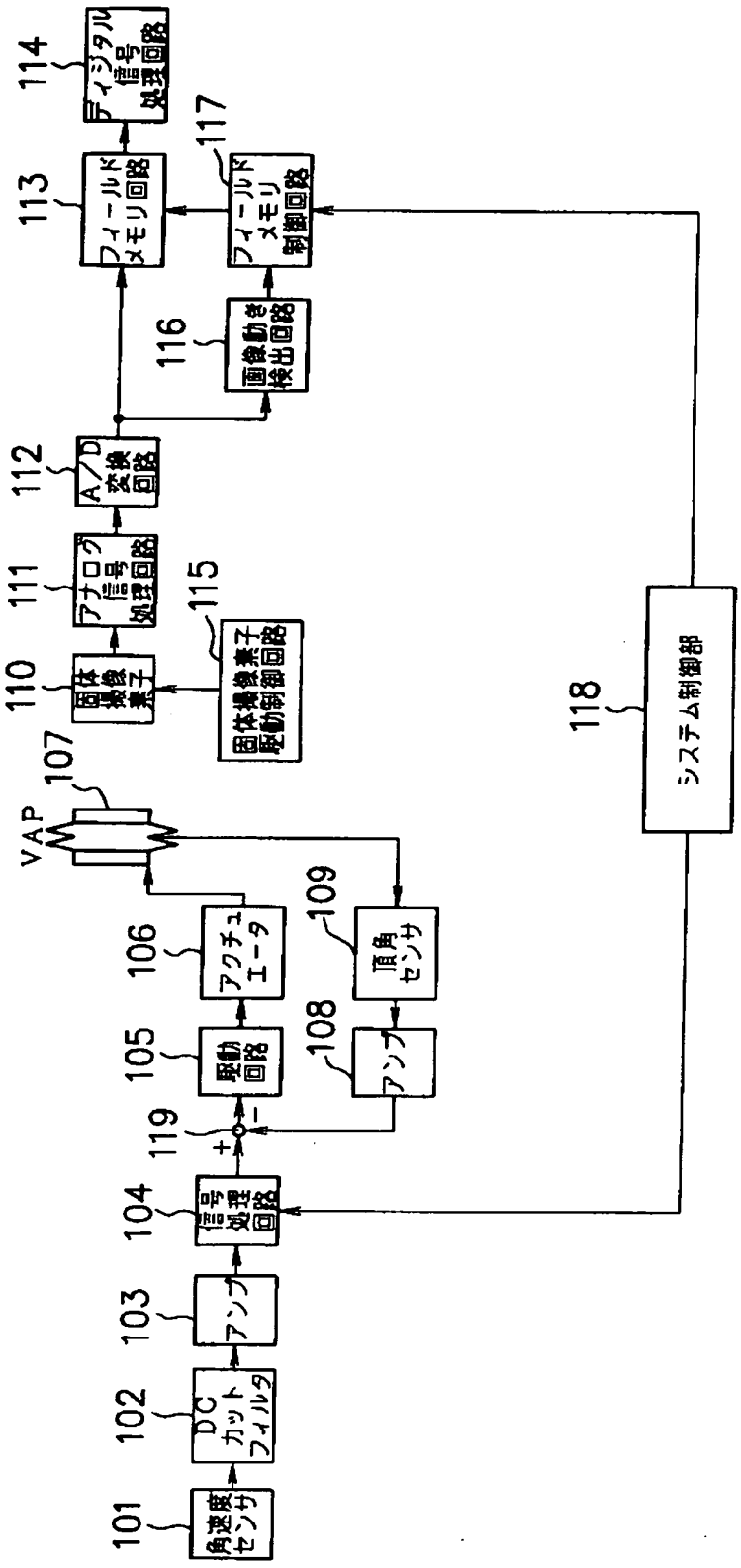
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

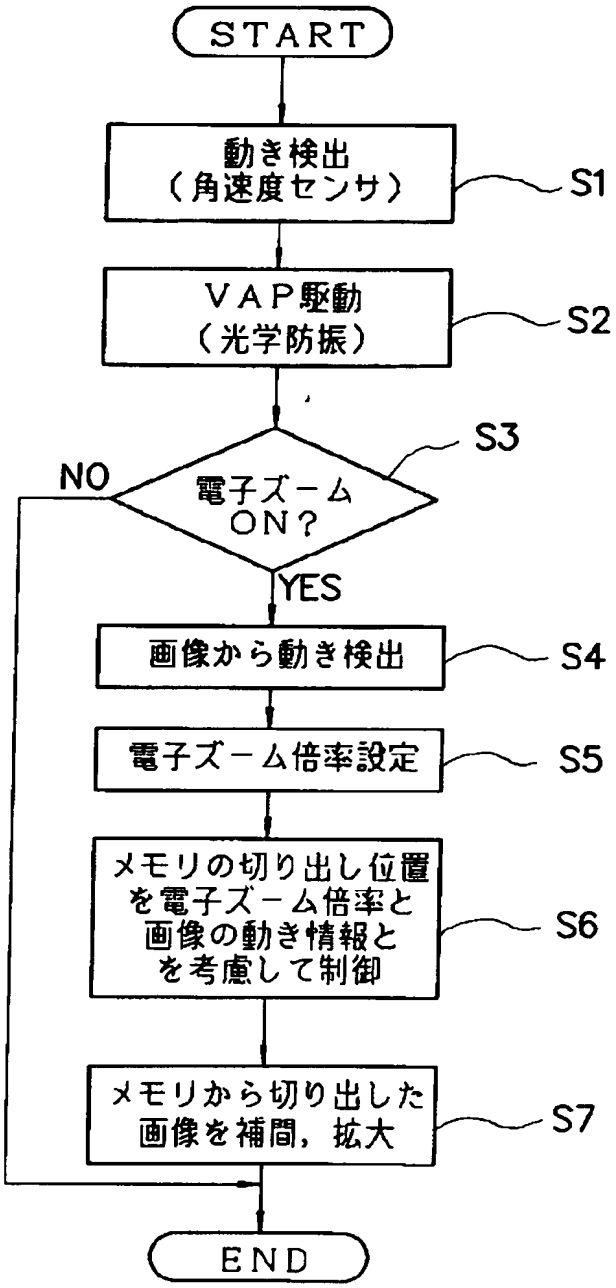
[Drawing 2]



[Drawing 1]


101
角速度センサ
102
DCカットフィルタ
103
アンプ
104
信号処理回路
105
駆動回路
106
アクチュエータ
107
VAP
108
アンプ
109
頂角センサ
110
固体撮像素子
111
アナログ信号処理回路
112
A/D変換回路
113
フィールドメモリ回路
114
ディジタル信号処理回路
115
固体撮像素子駆動制御回路
116
画像動き検出回路
117
フィールドメモリ制御回路
118
システム制御部
119
+
−

[Drawing 3]



[Translation done.]

* NOTICES *

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
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K

[Procedure amendment]
[Filing Date] December 13, Heisei 13 (2001. 12.13)
[Procedure amendment 1]
[Document to be Amended] Description
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] A storage means to memorize the picture signal inputted from an image pick-up means,
A motion detection means to detect a motion of the above-mentioned picture signal,
the deflection compensator characterized by having the control means which carries out reading appearance and controls [above-mentioned] the location of the range according to the motion by which detection was carried out [above-mentioned] while the picture signal from the above-mentioned storage means carries out reading appearance according to the specified zoom scale factor and controlling the magnitude of the range.
[Claim 2] The above-mentioned control means is a deflection compensator according to claim 1 characterized by moving the location of the above-mentioned read-out range in the direction which decreases the above-mentioned motion into the field except the above-mentioned read-out range of the above-mentioned storage means.
[Claim 3] The procedure of memorizing the picture signal inputted from an image pick-up means for a storage means,
The procedure of detecting a deflection,
the deflection amendment approach characterized by having the procedure which carries out reading appearance and controls [above-mentioned] the location of the range according to the motion by which detection was

carried out [above-mentioned] while the picture signal from the above-mentioned storage means carries out reading appearance according to the specified zoom scale factor and controlling the magnitude of the range.
[Claim 4] The deflection amendment approach according to claim 3 characterized by moving the location of the above-mentioned read-out range in the direction which decreases the above-mentioned motion in the above-mentioned procedure which carries out control into the field except the above-mentioned read-out range of the above-mentioned storage means.
[Claim 5] Processing which memorizes the picture signal inputted from an image pick-up means for a storage means,
Processing which detects a motion of the above-mentioned picture signal,
the storage which memorized the program for performing processing which carries out reading appearance and controls [above-mentioned] the location of the range according to the motion by which detection was carried out [above-mentioned] while the picture signal from the above-mentioned storage means carries out reading appearance according to the specified zoom scale factor and controlling the magnitude of the range and in which computer reading is possible.
[Claim 6] The storage which is characterized by moving the location of the above-mentioned read-out range in the direction which decreases the above-mentioned motion in the above-mentioned processing which carries out control into the field except the above-mentioned read-out range of the above-mentioned storage means and in which computer reading according to claim 5 is possible.
[Claim 7] An electronic amendment means to amend a motion of the image by the deflection electronically,
An electronic zoom means to expand an image electronically,
It is the deflection compensator which an optical amendment means amends a motion of the image by the deflection optically at the time of un-operating [of the above-mentioned electronic zoom means], and is characterized by having the control means which both the above-mentioned optical amendment means and the above-mentioned electronic amendment means are operated, and amends a motion of an image at the time of actuation of the above-mentioned electronic zoom means.
[Claim 8] The above-mentioned control means is a deflection compensator according to claim 7 characterized by making it change the range of the above-mentioned electronic amendment means which can be amended with the scale factor of the above-mentioned electronic zoom means.
[Claim 9] A deflection detection means to detect a deflection physically,
A motion detection means to detect a motion of the image by the deflection from the temporal response of a picture signal,
An optical amendment means to amend a motion of the image by the deflection optically,
An electronic amendment means to amend a motion of the image by the deflection electronically,
The deflection compensator characterized by having the control means which operates the above-mentioned optical amendment means based on the output of the above-mentioned deflection detection means, and operates the above-mentioned electronic amendment means based on the output of the above-mentioned motion detection means.
[Claim 10] It is the deflection compensator according to claim 9 characterized by performing an electronic zoom by the above-mentioned control means's changing the image read-out range from the memory which memorized the picture signal, and expanding an image by having an electronic zoom means to expand a picture signal electronically, and moving the above-mentioned image read-out range in the field in memory other than the image read-out range.
[Procedure amendment 2]
[Document to be Amended] Description
[Item(s) to be Amended] 0007
[Method of Amendment] Modification
[Proposed Amendment]
[0007]
[Means for Solving the Problem] while the picture signal from the above-mentioned storage means carries out reading appearance according to the zoom scale factor specified as a storage means memorize the picture signal inputted from an image pick-up means in the deflection compensator by this invention, and a motion detection means detect a motion of an above-mentioned picture signal and controlling the magnitude of the range, the control means which carries out reading appearance and controls [above-mentioned] the location of the range

has prepared according to the motion by which detection was carried out [above-mentioned].
[Procedure amendment 3]
[Document to be Amended] Description
[Item(s) to be Amended] 0008
[Method of Amendment] Modification
[Proposed Amendment]
[0008] while the picture signal from the above-mentioned storage means carries out reading appearance according to the zoom scale factor specified as the procedure memorize the picture signal inputted from an image pick-up means for a storage means in the deflection amendment approach by this invention, and the procedure detect a deflection and controlling the magnitude of the range, the procedure which carries out reading appearance and controls [above-mentioned] the location of the range has formed according to the motion by which detection was carried out [above-mentioned].
[Procedure amendment 4]
[Document to be Amended] Description
[Item(s) to be Amended] 0009
[Method of Amendment] Modification
[Proposed Amendment]
[0009] In the storage by this invention in which computer reading is possible While controlling the magnitude of the read-out range of the picture signal from the above-mentioned storage means according to the zoom scale factor specified as the processing which memorizes the picture signal inputted from an image pick-up means for a storage means, and the processing which detects a motion of the above-mentioned picture signal The program for performing processing which controls the location of the above-mentioned read-out range according to the motion by which detection was carried out [above-mentioned] is memorized.
[Procedure amendment 5]
[Document to be Amended] Description
[Item(s) to be Amended] 0010
[Method of Amendment] Modification
[Proposed Amendment]
[0010] An electronic amendment means to amend a motion of the image by the deflection electronically in other deflection compensators by this invention, At the time of un-operating [of an electronic zoom means to expand an image electronically, and the above-mentioned electronic zoom means] The optical amendment means amended the motion of the image by the deflection optically, and the control means which both the above-mentioned optical amendment means and the above-mentioned electronic amendment means are operated, and amends a motion of an image is established at the time of actuation of the above-mentioned electronic zoom means.
[Procedure amendment 6]
[Document to be Amended] Description
[Item(s) to be Amended] 0028
[Method of Amendment] Modification
[Proposed Amendment]
[0028]
[Effect of the Invention] Since it constituted according to this invention so that the read-out range of the picture signal from a storage means might be controlled according to a motion of the picture signal detected and electronic deflection amendment might be performed as explained above, it becomes possible to remove the deflection of the low-pass frequency band in an electronic zoom field to high degree of accuracy. Moreover, since according to this invention it constituted so that both an optical amendment means and an electronic amendment means might be operated at the time of actuation of an electronic zoom means, the deflection amendment which removes the deflection of the low-pass frequency band which had become a problem with the optical deflection compensator in the electronic zoom field to high degree of accuracy, and does not have image quality degradation is realizable. Furthermore, since according to this invention it constituted so that an optical amendment means to amend a motion of the image by the deflection optically, and an electronic amendment means to amend a motion of the image by the deflection electronically similarly might be used together, in the optical deflection compensator which performs only optical deflection amendment, it becomes

possible to remove the deflection of the low-pass frequency band used as a problem to high degree of accuracy.

[Translation done.]